

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
14 June 2001 (14.06.2001)

PCT

(10) International Publication Number  
**WO 01/42667 A1**

(51) International Patent Classification: **F16B 5/06.**  
B44D 3/18

(21) International Application Number: PCT/NL00/00912

(22) International Filing Date:  
11 December 2000 (11.12.2000)

(25) Filing Language: Dutch

(26) Publication Language: English

(30) Priority Data:  
1013816 10 December 1999 (10.12.1999) NL  
1014709 21 March 2000 (21.03.2000) NL

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(81) Designated States (*national*): AE, AL, AM, AT, AU, AZ,  
BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK,  
DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL,  
IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU,  
LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT,  
RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA,  
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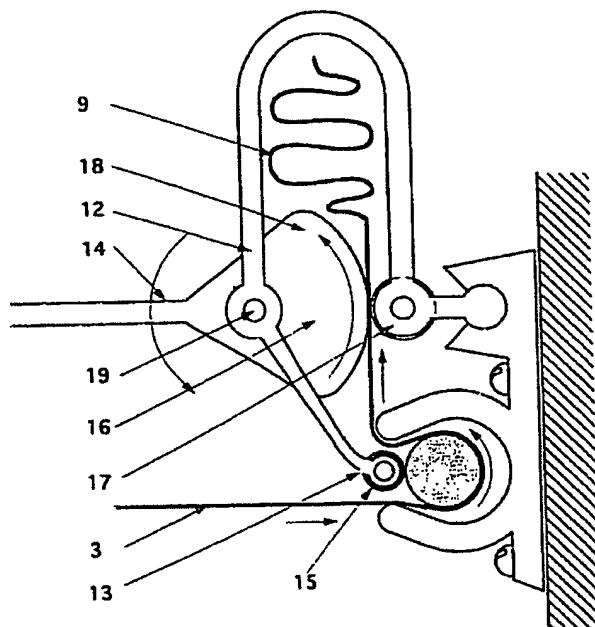
(84) Designated States (*regional*): ARIPO patent (GH, GM,  
KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian  
patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European  
patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE,  
IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF,  
CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG)

**Published:**

- With international search report.
- Before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments.

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: **CLAMPING APPARATUS**



(57) Abstract: The invention relates to a clamping apparatus for a flexible material, such as a woven fabric, a film or the like, comprising a moulding for clampingly holding the material. The moulding comprises a housing and a housing includes a clamping member, and in that the housing comprises two walls whose ends are inclined towards each other such that they leave an opening for the insertion of the flexible material, which flexible material at least partially surrounds the clamping member in the housing, and which opening is suitable for locking the clamping member.

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## Clamping apparatus

The invention relates to a clamping apparatus for a flexible material, such as a woven fabric, a film or the like, comprising a moulding for clampingly holding the material.

Such a clamping apparatus is known in practice. Picture frames, for example, have been known from time immemorial.

10 It is the object of the invention to provide a clamping apparatus that with a very few parts provides an effective fastening of the flexible material, such that it can be tensioned, can be removed, and tensioned again, while avoiding damage to the flexible material. With re-  
15 gard to the flexible materials that are to be used, these may be woven fabrics, plastic films, and paper. Such flexible materials have considerable advantages compared with known rigid materials. Flexible material is easier to transport, the material may be less fragile, and it can be  
20 applied in larger dimensions. Other possibilities are flexible materials having specific qualities, for example, for sun protection or for the reduction of ultraviolet radiation. For all these kinds of applications a flexible and widely applicable system for fastening is needed. The  
25 invention is aimed at filling this need.

The clamping apparatus according to the invention is characterized in that the moulding comprises a housing which housing includes a clamping member, and in that the housing comprises two walls whose ends are inclined to-  
30 wards each other such that they leave an opening for the insertion of the flexible material, which flexible material at least partially surrounds the clamping member in the housing, and which opening is suitable for locking the clamping member. This provides a very flexible and adjust-  
35 able clamping action for clamping the flexible material,

by which a superior result may be obtained when tensioning said material.

The simplicity of operating this clamping apparatus according to the invention also makes it especially  
5 suitable for the temporary fastening of materials. This is in particular promoted by the embodiment which is characterized in that at least one wall of the housing is adjustable.

A very secure and effective clamping action may  
10 be obtained when the clamping member and/or the walls of the housing are provided with a roughened surface. In one particular aspect of the invention the clamping apparatus is characterized in that the housing comprises at least a first portion, and a second portion that is removable from  
15 the first portion, wherein the first portion is equipped for fastening to a wall, ceiling, or the like, and the second portion is geared for accommodation in the first portion such as to form the housing. In this way a versatile suspension system for flexible materials may be realized, using standard parts which can be fastened either to  
20 ceilings or to walls.

To facilitate a simple operation of the clamping apparatus according to the invention it is desirable that the clamping member be provided with a centrally located  
25 recess for a turning tool.

Alternatively, the clamping apparatus may be executed such that the clamping member is provided with a squared exterior surface, which is equipped to engage a tensioning member. In this embodiment also, operation may  
30 be quite simple.

In a further aspect of the invention the clamping apparatus may be provided with a removable masking strip applied on the housing. Indeed, this provides the additional advantage that this masking strip may be designed  
35 such that a first end of said strip abuts to the housing and a second end presses against the flexible material at the opening for the insertion of the material. In this way

a very nicely finished tensioning of the flexible material may be achieved.

In yet another aspect of the invention, the clamping apparatus is provided with a removable tensioning member, wherein the tensioning member comprises a lever of which one end can be firmly placed near the housing, and a hook that is coupled with the lever which is equipped for operating the clamping member incorporated in the housing.

To make the tensioning member adequately operable, it is desirable that at its side facing the clamping member, the hook be provided with a first rolling member.

Especially innovative is the embodiment in which the lever is rotatably mounted on the hook and possesses a disk shaped like a circle segment, which is equipped to engage a second rolling member mounted on the hook, the hook having a pivoting coupling near the housing.

The invention will now be explained in more detail with reference to the drawings, which in the Figures 1 to 31 show various aspects of the clamping apparatus according to the invention.

The basic embodiment according to Figure 1, shows a cross section of a construction basically comprising round element 1, surrounded by a casing 2 whose two inclining walls 4 define an opening that is smaller than the round element 1. The flexible material 3 to be tensioned is guided around the round element 1. Basically this construction is embodied as moulded strip. In all the embodiments described below flexible material 3 is minimally at one side fastened to a construction 5 which with respect to the casing 2 is fixed in such a way that the material 3 can be stretched between said construction 5 and casing 2.

Figure 2 shows a construction with which it is possible to tension flexible material. To this end the round element 1 is provided with preferably an internal recess 6 to allow engagement by means of a tensioning tool. This recess maybe rectangular, triangular or multi-angular. However, the recess is preferably shaped like a

regular hexagon adapted to standard tools with a hexagonal cross section.

When a strip of flexible material 3 is fastened to round element 1, this material will turn with the rotational movement of round element 1. The rolled-up edge 9 of flexible material 3 forms a roll 7. The internal space in casing 2 is dimensioned such that it can accommodate sufficient rolled up material. Figure 3, shows the situation where the flexible material 3 is wound about round element 1 and it is tensioned in the direction indicated with 8. The round element 1 is thus pulled against the walls 4 of the casing 2 whereby the flexible material 3 becomes clamped.

A comparable method as described above for tensioning may also be applied for slackening the flexible material. The advantage of this method is that the construction of casing 2 may be realized extremely simply and cheaply. Figure 4 shows a spatial illustration of the round element 1 and the tensioning tool 10. As the described systems are intended to fasten the flexible material over the entire width of the casing 2, the construction is preferably embodied as extrusion moulding. In this way the effect occurs over the full length of the profile. If the shape of the recess 6 is symmetrical, the spanner 10 can in principle be used at both ends of round element 1.

Below a further detail of round element 1 will be described, presenting additional possibilities. The length of round element 1 must be chosen such that the torsional force exerted by the spanner 10 will not result in a harmful degree of torsion in the longitudinal axis of round element 1. This torsion could cause an unevenly distributed tensioning in flexible material 3. By allowing the rotational force to affect not only the ends but also the middle, it is possible to prevent torsion in element 1. Figure 5, shows a further improvement of element 1 by which means said effect may be realized over the entire length of round element 1.

To this end the circumference of element 1 is provided with a star-shaped profile. This shape provides over the entire circumference engagement surfaces 11 for a basically rod-like tensioning tool 12. When said tensioning tool 12 is pushed in direction 13 against engagement surface 11, element 1 will rotate in a direction 8.

To facilitate proper functioning, the edge of flexible material 3 is guided around element 1 in the manner shown in Figure 6. This leaves the engagement surface 11 accessible to tensioning tool 12. The exertion of force 13 on engagement surface 11 makes that in direction 14 a degree of tensile force is exerted on the free edge 9 of flexible material 3, ensuring a good holding power between element 1 and flexible material 3. After rotation, the tensioning tool 12 is allowed to engage the next engagement surface 11 causing a step by step movement of the flexible material 3 in direction 8, whereby tensioning can be accomplished. This construction provides a simple manner for feeding the flexible material 3 through casing 2 by means of rotating element 1. To facilitate proper functioning, the interior of the casing 2 is round having a dimension such as to surround the element 1 with only a small amount of play.

Figure 7, shows a construction that makes it possible to tension flexible material without changing the position of the casing 2. To this end the casing 2 is provided with a separate tensioning tool characterized by the following parts.

The tensioning tool 10 is movably connected to the casing 2 by means of a permanent pivoting point 11. Part 12 applies to a load arm located between pivoting point 11 and hook 13. Part 14 is an arm of force of an embodiment that will be explained in more detail. Hook 13 preferably forms a circle segment, of which pivoting point 11 forms the centre. The radius of said circle segment is such that it falls just inside the opening 7 of the casing 2. Hook 13 eccentrically touches the round element 1 at the side of the surface 4. When the tensioning tool 10 is

pushed inwards, round element 1 will be pushed inwards. Due to the eccentric engagement, the round element 1 will during this operation make a rotating axial movement in the same rotational direction as the tensioning tool 10.

5           When there is a strip of flexible material 3 around element 1, said strip will also turn in the same rotational direction as the round element 1. When furthermore said flexible material is fastened at the opposite side to a point that in relation to casing 2 is fixed, 10 this operation will cause it to become tensioned. Figure 8 shows a method wherein during operation the free edge strip 9 is located between the round element 1 and the hook 13. Due to the fact that the hook 13 presses the edge strip 9 tightly around the round element 1, the flexible 15 material 3 will turn with the rotation of the round element 1. This operation may be repeated by alternately moving the tensioning tool 10 in the direction described and in the opposite direction. By pulling on the edge strip 9, the round element 1 rolls step by step in the direction of 20 the edge strip 9, thereby tensioning the flexible material 3.

The advantage of this method is that the flexible material does not become damaged. The effect of this advantage is especially noticeable when the flexible material has to be removed and tensioned anew. 25

A method comparable to the one described above for tensioning may also be applied for releasing the flexible material. Figure 9, shows an implementation of tensioning tool 10 that effectuates the release of the 30 flexible material 3. The hook 13 is positioned such that the force on round element 1 passes through its centre. By pushing the hook 13 of tensioning tool 10 against round element 1, the same will come away from the walls of casing 2. This operation allows the tension on the flexible 35 material 3 to be reduced to such an extent that it can easily be extricated from the casing 2.

Figure 10, shows a more sophisticated tensioning tool 10. For a quick feed-through of a wide strip of the

flexible material, the hook 13 may be provided with a rotatable guide roller 15. As a result, the round element 1 will experience less resistance when turning. In order to give the edge strip 9 more room for coming out of the casing 2, the load arm 12 may be curved.

The edge strip 9 may be tensioned manually or with the aid of a tool. Known are the spring chucks that are used for tensioning painter's canvas on canvas stretchers. Flexible material may be tensioned in accordance with the above-described construction by using a special tensioning device, as described below.

Figure 11 shows a further elaboration on tensioning tool 10, making it possible with one operation to release the round element 1, in order to allow it to rotate freely, and to tension the edge strip 9. To this end the lever of force 14 is rotatable around pivoting point 19 and connected with the other parts. The lever of force 14 is provided with an extension piece 16. The end is provided with a circle segment 18 whose centre coincides with the pivoting point 19. In this variation, load arm 12 is curved to give the edge strip 9 some room. Load arm 12 is further provided with a preferably spring-activated cylindrical rotatable element 17. The circle segment 18 touches rotatable element 17 such that a degree of clamping action occurs. The inwardly-directed tensioning movement of load arm 14 described above will cause circle segment 18 to move in the opposite direction. Edge strip 9 is inserted between rotatable element 17 and circle segment 18. The flexible material 3 is tensioned by turning tensioning tool 10 in the direction of the round element 1. When pushing the hook 13 against the round element 1, the extension piece 16 simultaneously pulls edge strip 9. In this way both movements are carried out to effectuate the tensioning of flexible material 3. Preferably, hook 13 is provided with a guide roller 15. This will reduce the resistance round element 1 experiences due to hook 13, which facilitates the slackening of the flexible material.



Since the systems described are intended to fix the flexible material over the entire circumference, the construction consisting of round element 1 and casing 2 is preferably executed as extrusion moulding. In this way the effect can take place over the entire length of the moulding and thus over the entire circumference of the flexible material 3. In essence, the tensioning tool 10 may be applied at any position in the longitudinal direction of the casing 2.

10           Hereinbelow a further detail of round element 1 will be described for the improvement of the effect. If round element 1 is made from a rigid material, insertion over an extensive length may be difficult. Any deviation from the straight line will result in a reduced clamping action and will impede the rotation and consequently the tensioning.

          The effect of tensioning tool 10 locally induces a tangential force on round element 1, resulting in a torsional force. If round element 1 is made from a rigid material, said torsional force is distributed over a certain length. This results in an increase in the width over which flexible material 3 is being tensioned. As a consequence, the force required from tensioning tool 10 also increases.

25           If flexible material 3 consists of a rectangular sheet, it may be mounted in a framework formed by the above-described construction of casing 2 and round element 1. During tensioning of the flexible material, it will be stretched slightly in the longitudinal direction of the casing 2. The clamping construction needs to accommodate this stretching in the longitudinal direction of a moulding. If both the round element 1 and the casing 2 are made from rigid material, said stretching cannot be compensated. This may result in the development of creases.

35           A solution to the above-mentioned drawbacks may be found by making the round element 1 from a slightly flexible and elastic material, for example, from rubber. This provides the following advantages. The insertion of

round element 1 into casing 2 is easier, especially when large dimensions are involved. The torsional force produced by tensioning tool 10 in the round element 1 when the flexible material 3 is being tensioned, is distributed  
5 over a shorter length, thereby facilitating the tensioning of flexible material 3. The adhesion of flexible material 3 between round element 1 and casing 2 is improved, the good clamping action is independent of the straightness of round element 1, and round element 1 is capable of  
10 slightly stretching with the flexible material 3 when the same is being stretched in the longitudinal direction of casing 2.

A particular embodiment of the casing 2 is intended to facilitate the insertion of flexible material.  
15 To this end casing 2 is embodied such that the opening 7 can be enlarged to insert the round element 1 together with the flexible material. This is especially useful when the flexible material has large dimensions.

One of the inclining sides of casing 2 is then  
20 provided with a movable part 20. This may be a sliding part as shown in Figure 12, a pivoting part as shown in Figure 13, a tilting part as shown in Figure 14, or variations on these.

The above-mentioned illustrations depict the  
25 closed position, the opened position of the three variations are illustrated in Figure 15, Figure 16, and Figure 17, respectively.

To further promote proper functioning, the round element 1 may be provided with a roughened surface or a  
30 cross sectional profile such as illustrated in Figure 18.

As further improvement to promote the clamping action, the insides of the side surfaces 4 and 5 of casing 2 may be provided with a profile, as illustrated in Figure 19.

35 As further improvement to promote proper functioning, the casing 2 may be embodied as asymmetrical extrusion profile. The advantages described above may then be combined with functional advantages to be mentioned be-

low. For the sake of clarity, the pivoting point 11 is not shown in the following illustrations.

Figure 20 shows an embodiment wherein casing 2 is asymmetrical. To this end the lateral surface 4 is extended to the centre line of the fastening means by which casing 2 is fastened. In this arrangement use is made of a symmetrical fastening means 21. This is used to tension flexible material 3 in a plane oriented perpendicularly to the mounting face 22. The advantage of this embodiment is that the tension on flexible material 3 does not exert a moment force on the casing 2. This is also an advantage when casing 2 is flexibly mounted as shown in Figure 21.

Figure 22, shows an arrangement wherein the flexible material is tensioned parallel to the mounting face 22. The asymmetrical embodiment of casing 2 is then mounted such that the opposite side and movable part 20 are placed on the mounting face 20 at right angles. The result is that the entire construction is located behind the visible surface 24 of the flexible material. This may be aesthetically advantageous because the tensioning construction is not visible. It is also economically advantageous because the quality of the construction's finish needs to meet fewer demands.

In this arrangement the lateral surface 4 is placed at an incline with respect to mounting face 22. By this embodiment the flexible material only touches the rim of the lateral surface 4. This has the advantage that if a light source 23 is provided to illuminate its reverse side, the visible surface 24 may be illuminated up to the rims. This arrangement may be realized by mounting the casing 2 on an asymmetrical mounting bracket 25. This may consist of an extruded moulding.

Figure 23 demonstrates the accessibility of the tensioning mechanism. By moving movable part 20 into its rearmost position, an opening is created to facilitate the simple insertion of round element 1 and the flexible material 3. After insertion, a simple manual operation will bring the movable part 20 into the position necessary for

the clamping action. By means of a raised edge, movable part 20 is locked in this position.

Depending on the application, it may be desirable to position the construction differently in relation to the flexible material. The fastening surface 26 of the fastening moulding 25 is preferably positioned such as to form an angle of  $22.5^\circ$  with the wall mounting face 22. The casing 2 and fastening moulding 25 are preferably coupled by means of a symmetrical hook-like profile. This symmetrical profile allows the casing 2 to be mounted in two positions in relation to the mounting face 22. This benefits the application possibilities of the construction, as will be explained hereinbelow.

Figure 27, shows a situation in which the strip construction is mounted outside the visible surface 24. Such an arrangement may be desirable when the side of the visible surface 24 is not the same side as where the tensioning mechanism is operated. This situation may arise, for example, when the construction is mounted at the inside of a window. Since the construction is mounted outside the visible surface 24, it is completely and fully visible.

Figure 28 shows a situation in which the construction is mounted between the fastening faces. In the arrangement illustrated the tensioning mechanism is operated at the side of the visible surface 24. This arrangement is useful, for example, when the flexible material is stretched in front of a wall, between floor and ceiling.

Figure 29 also shows a situation in which the construction is mounted between the fastening faces. However, in this arrangement the tensioning mechanism is not operated at the visible side 24. This arrangement is useful, for example, when the flexible material is stretched in front of a window, between floor and ceiling. The tensioning construction is then mounted to the window frame.

Further, the construction may be provided with a decorative strip 27, as shown in Figures 30 and 31. The decorative strip does not constitute part of the construc-

tion. The advantage of this is that at the visible side any form may be chosen. This is important for bringing the appearance of the construction into harmony with the design's characteristic appearance. As a further elaboration, the decorative strip may be hollow for the accommodation of a broad edge strip 9. This possibility may come in useful when the flexible material has to be removed and replaced, for example, in order to replace the lighting at the reverse side.

10 Figure 24, shows a simplified construction in which casing 2 is mounted directly on the wall. In addition, this illustration shows an embodiment in which movable part 20 is removable. A particular feature is that movable part 20 is symmetrical so that incorrect placing  
15 is not possible. This illustration also shows a finishing strip 19, covering edge strip 9. The finishing strip is embodied such as to exert some degree of clamping action on the flexible material. In this way the finishing strip contributes to a smooth tensioning of the flexible material.  
20

If the mouldings of casing 2 are combined to a circumferential strip, it may be desirable to couple the parts. A generally known embodiment is the application of corner-joint elements. This achieves that the framework is  
25 kept together, which facilitates mounting. For this purpose, casing 2 may be provided with a profile 23 into which corner-joint elements 24 may be fitted, as shown in Figure 25.

Tensioning the flexible material 3 produces a  
30 considerable stress on the casing 2. In order to prevent the casing 2 from bending, it is desirable for these moulding strips to be mounted over their full length on a wall or a rigid surface. For this purpose simple Z-sections 25 may be used for fixing, as shown in Figure 26.

35 If casing 2 forms a square or rectangular frame, the four sides also have to be fixed with four such sections 25. In order to make it possible for all four sides of the framework formed by casing 2 to be hooked in the

most effective manner behind the fastening sections 25, the corner-joint elements 24 are slidably inserted into the profiles 23 of casing 2. This manner of execution combines the advantage of effective fastening with a convenient operability of the framework.

CLAIMS

5           1. A clamping apparatus for a flexible material,  
such as a woven fabric, a film or the like, comprising a  
moulding for clampingly holding the material, character-  
ized in that the moulding comprises a housing, which hous-  
ing includes a clamping member, and in that the housing  
10 comprises two walls whose ends are inclined towards each  
other such that they leave an opening for the insertion of  
the flexible material, which flexible material at least  
partially surrounds the clamping member in the housing,  
and which opening is suitable for locking the clamping  
15 member.

2. A clamping apparatus according to claim 1,  
characterized in that at least one wall of the housing is  
adjustable.

3. A clamping apparatus according to claim 1 or 2,  
20 characterized in that the clamping member is provided with  
a centrally located recess for a turning tool.

4. A clamping apparatus according to one of the  
preceding claims, characterized in that the housing com-  
prises at least a first portion, and a second portion that  
25 is removable from the first portion, wherein the first  
portion is equipped for fastening to a wall, ceiling, or  
the like, and the second portion is geared for accommoda-  
tion in the first portion such as to form the housing.

5. A clamping apparatus according to one of the  
30 claims 1-4, characterized in that the clamping member  
and/or the walls of the housing are provided with a rough-  
ened surface.

6. A clamping apparatus according to one of the  
claims 1-4, characterized in that the clamping member is  
35 provided with a squared exterior surface, which is  
equipped to engage a tensioning member.

7. A clamping apparatus according to one of the preceding claims, characterized in that a removable masking strip is provided; applied on the housing.

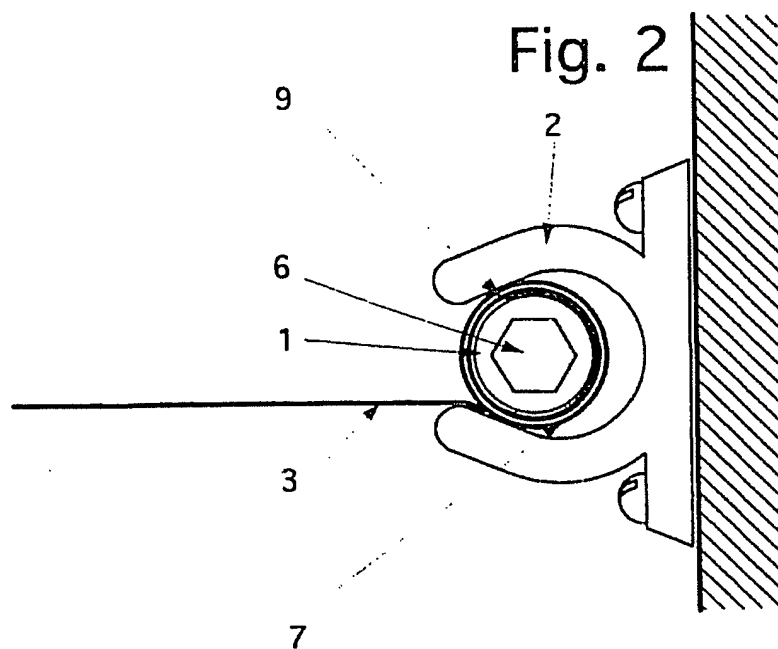
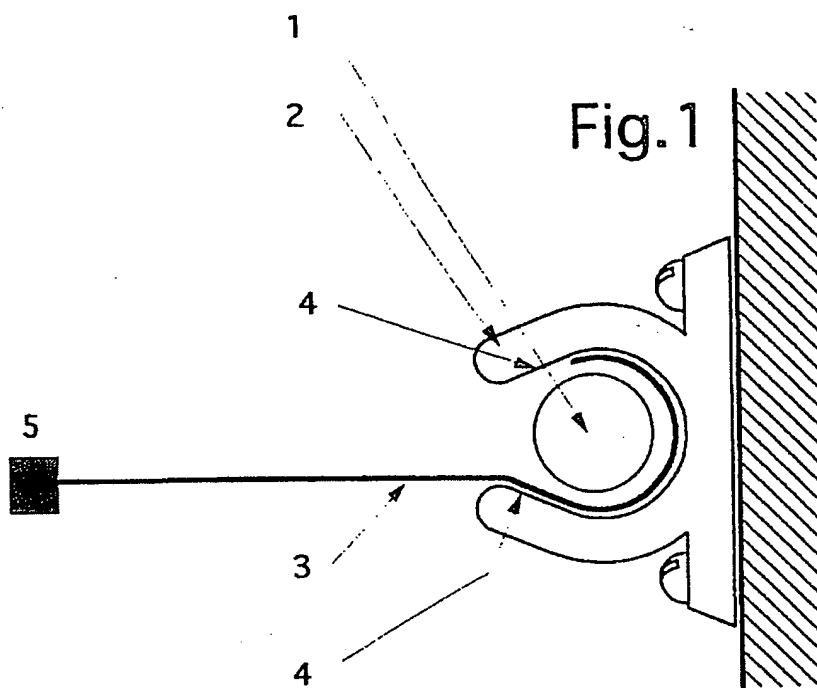
8. A clamping apparatus according to claim 7,  
5 characterized in that the masking strip at a first end abuts to the housing and at a second end presses against the flexible material at the opening for the insertion of the material.

9. A clamping apparatus according to one of the  
10 preceding claims, characterized in that the same is provided with a removable tensioning member, wherein the tensioning member comprises a lever of which one end can be firmly placed near the housing, and a hook that is coupled with the lever which is equipped for operating the clamp-  
15 ing member incorporated in the housing.

10. A clamping apparatus according to claim 9, characterized in that at its side facing the clamping member, the hook is provided with a first rolling member.

11. A clamping apparatus according to claim 9 or  
20 10, characterized in that the lever is rotatably mounted on the hook and possesses a disk shaped like a circle segment, which is equipped to engage a second rolling member mounted on the hook, the hook having a pivoting coupling near the housing.





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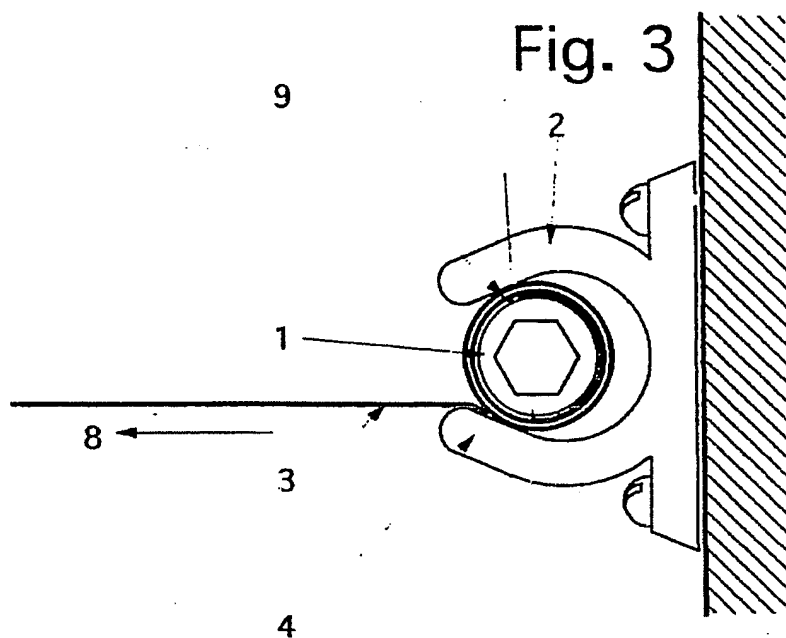
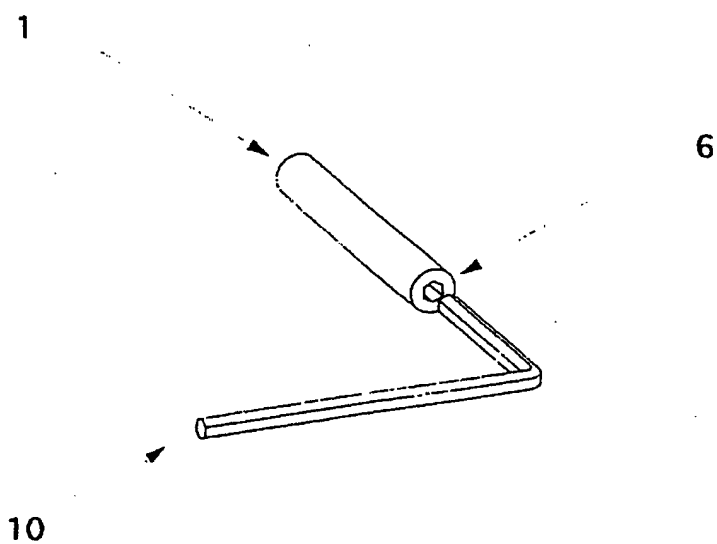


Fig. 4



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Fig. 5

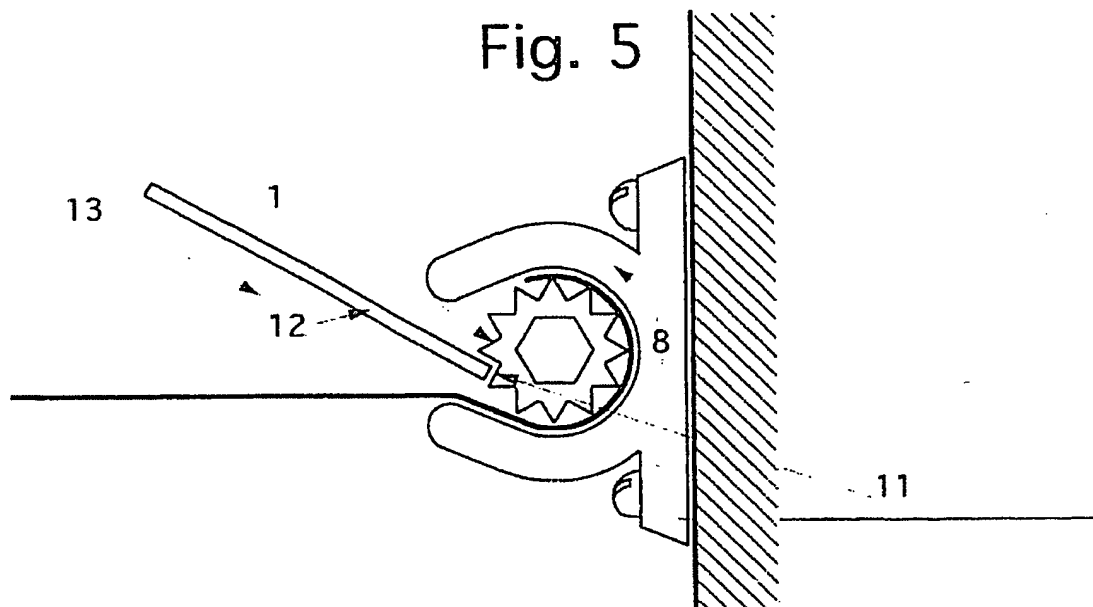
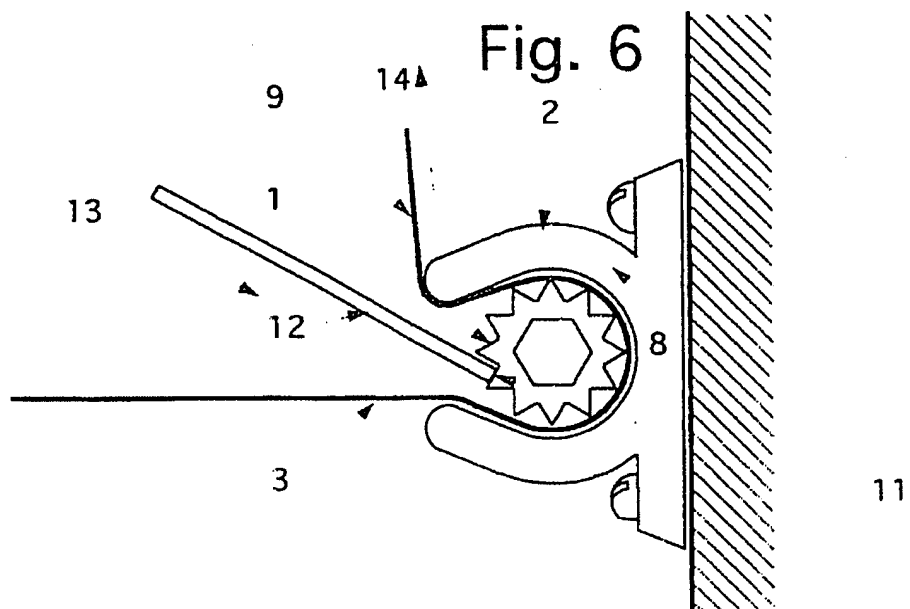


Fig. 6



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Fig. 7

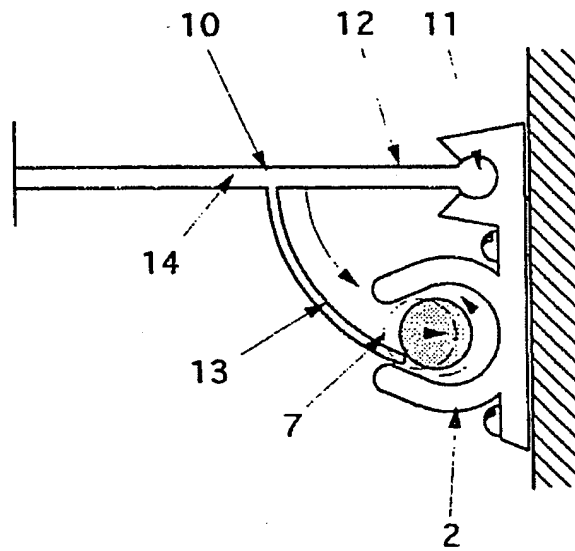
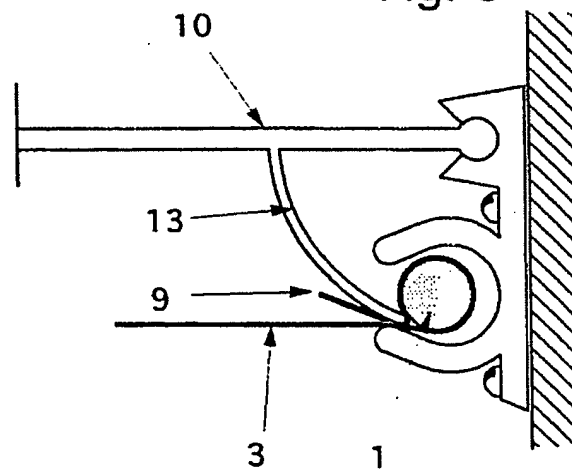


Fig. 8



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Fig. 9

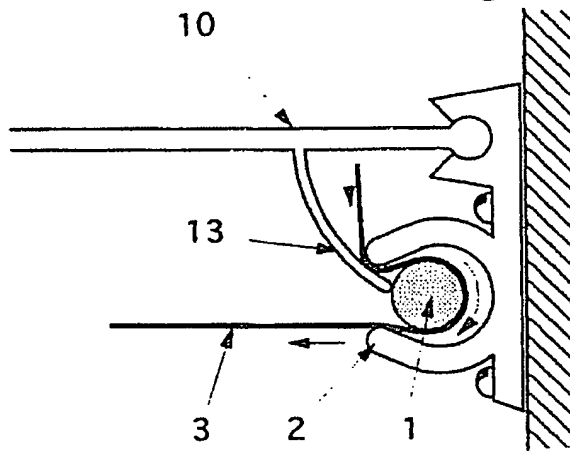


Fig. 10

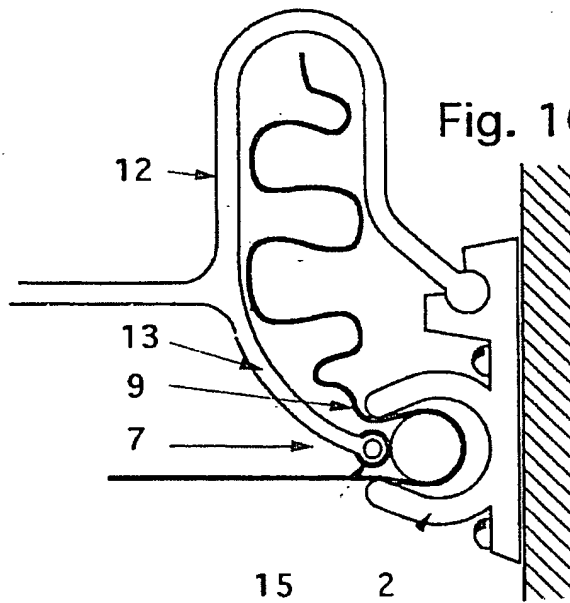




Fig. 12

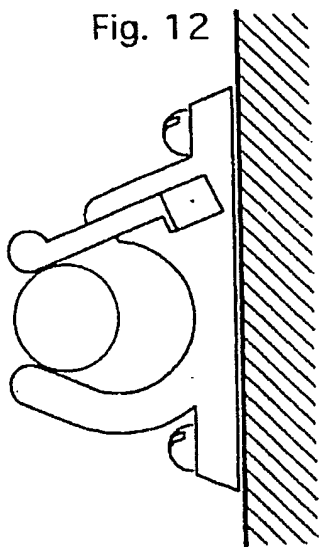


Fig. 15

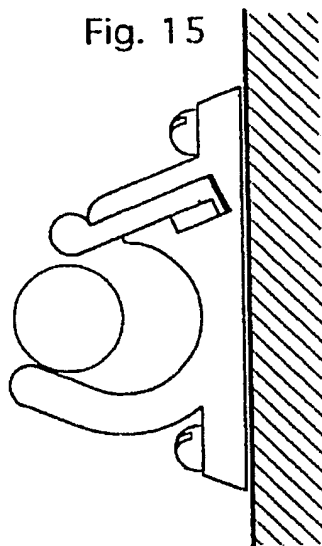


Fig. 13

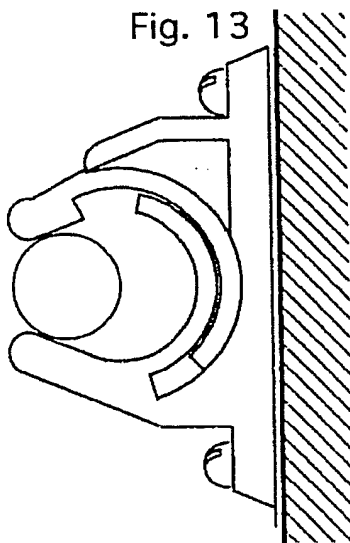


Fig. 16

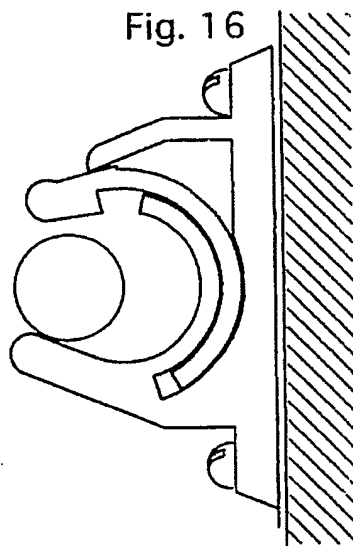


Fig. 14

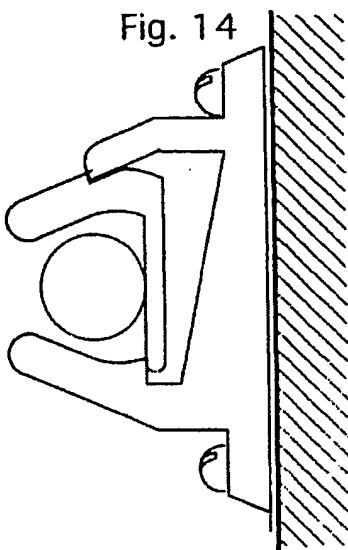
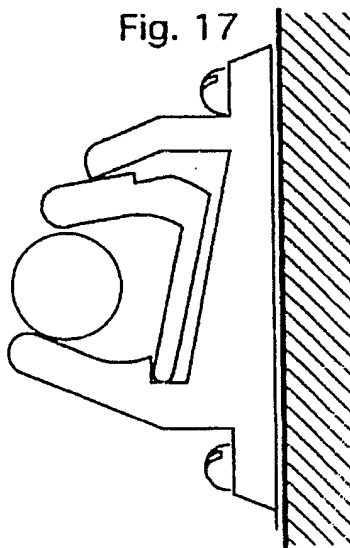


Fig. 17



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Fig. 18

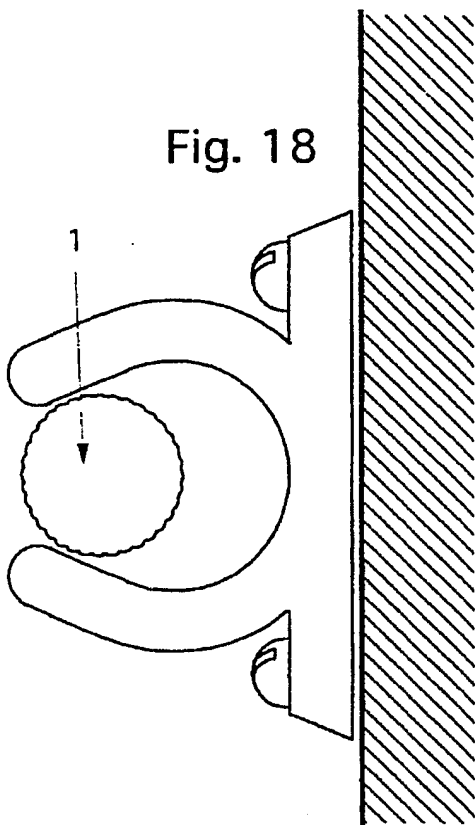
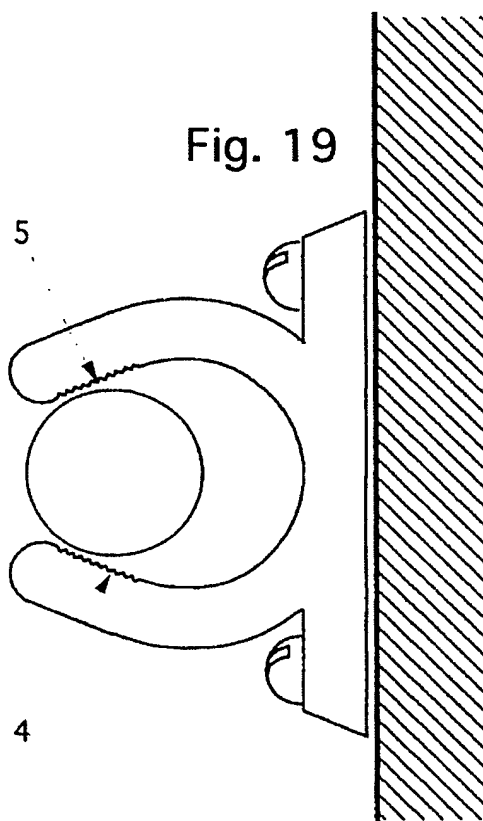


Fig. 19



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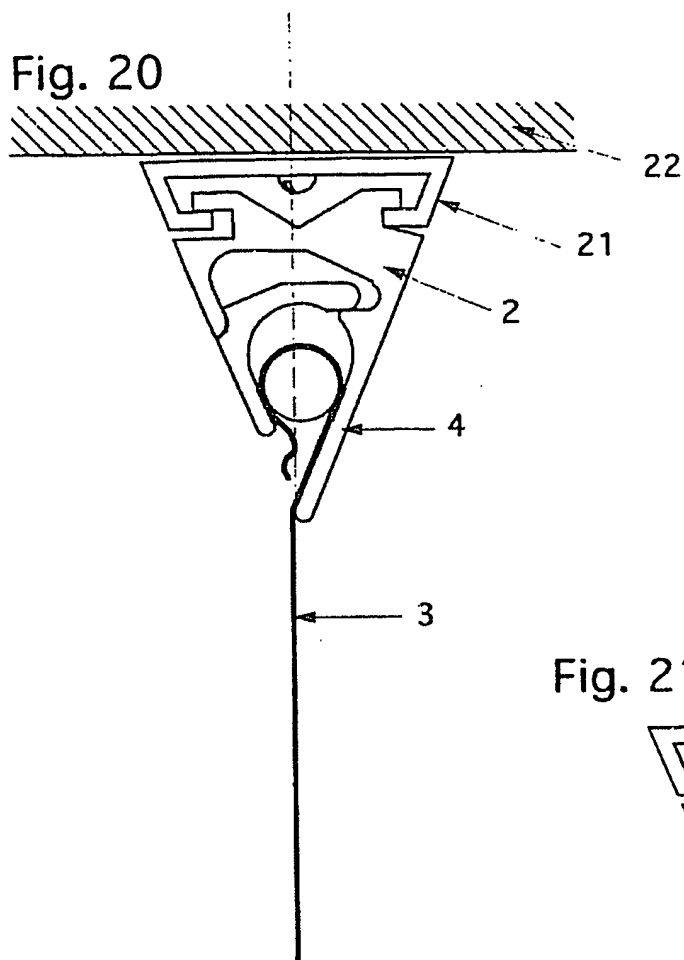
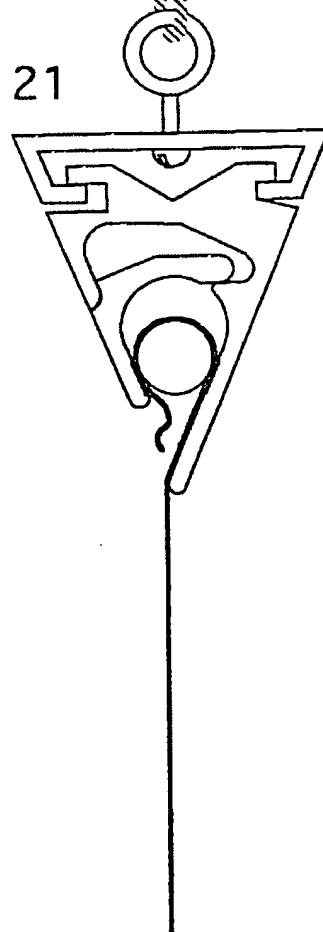
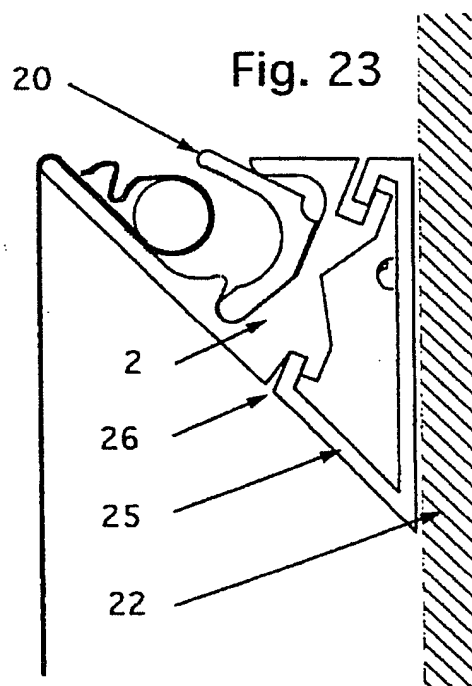
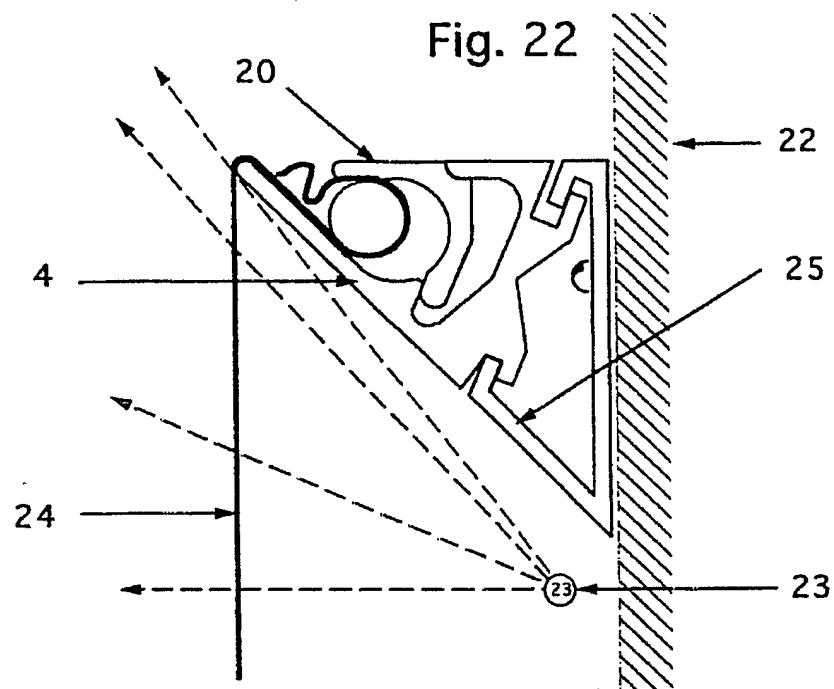


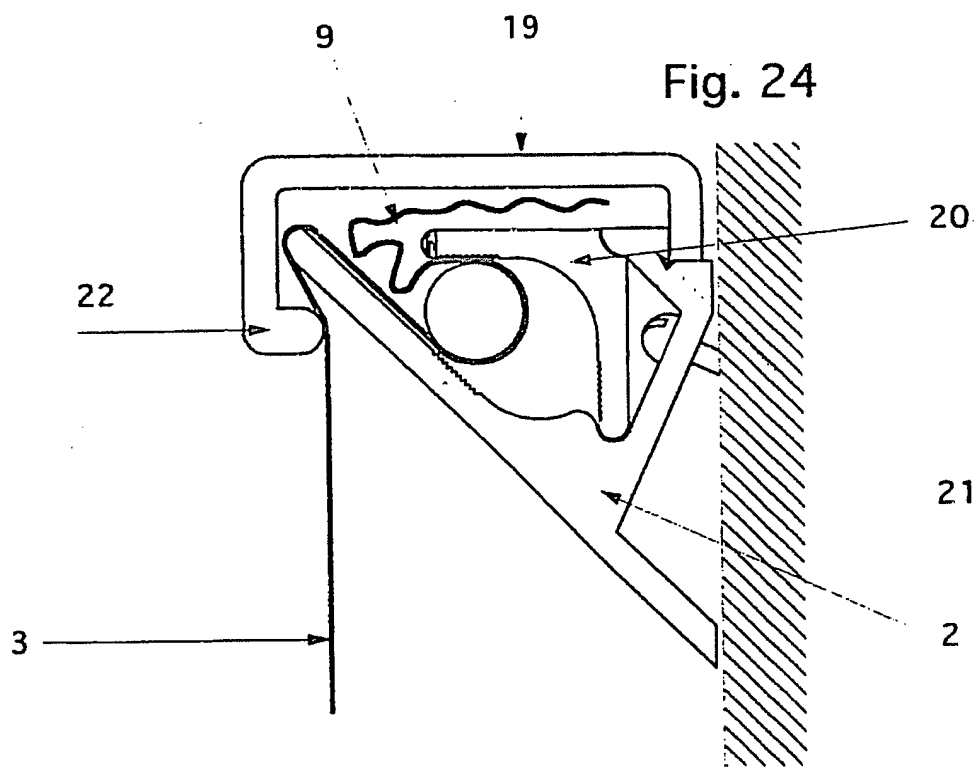
Fig. 21



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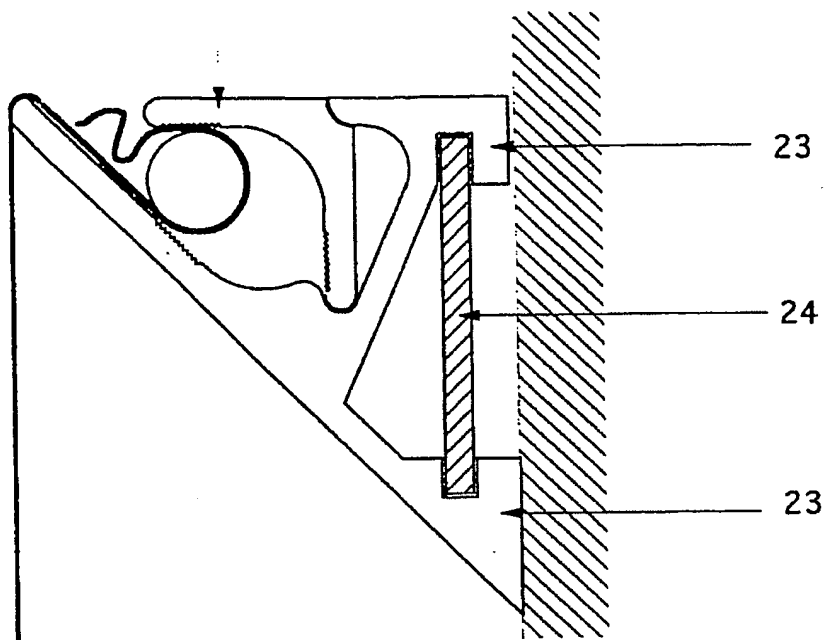


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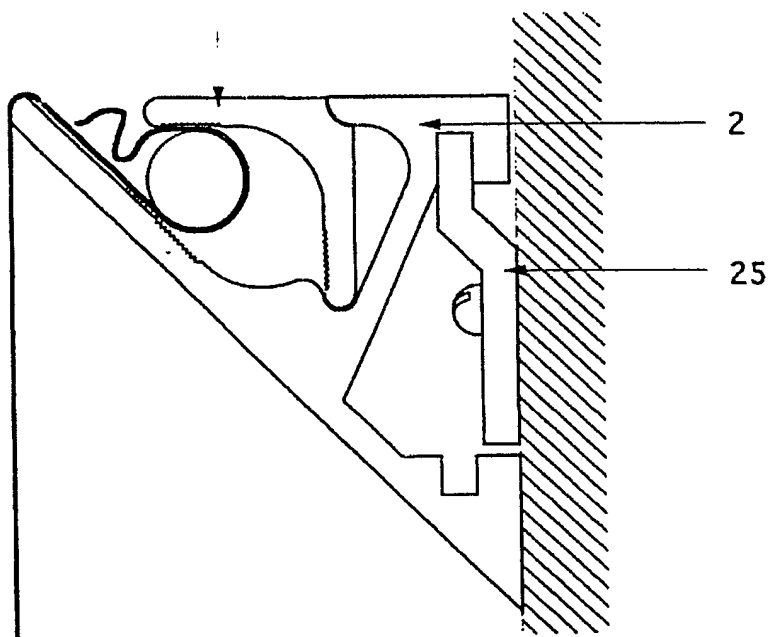
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Fig. 25



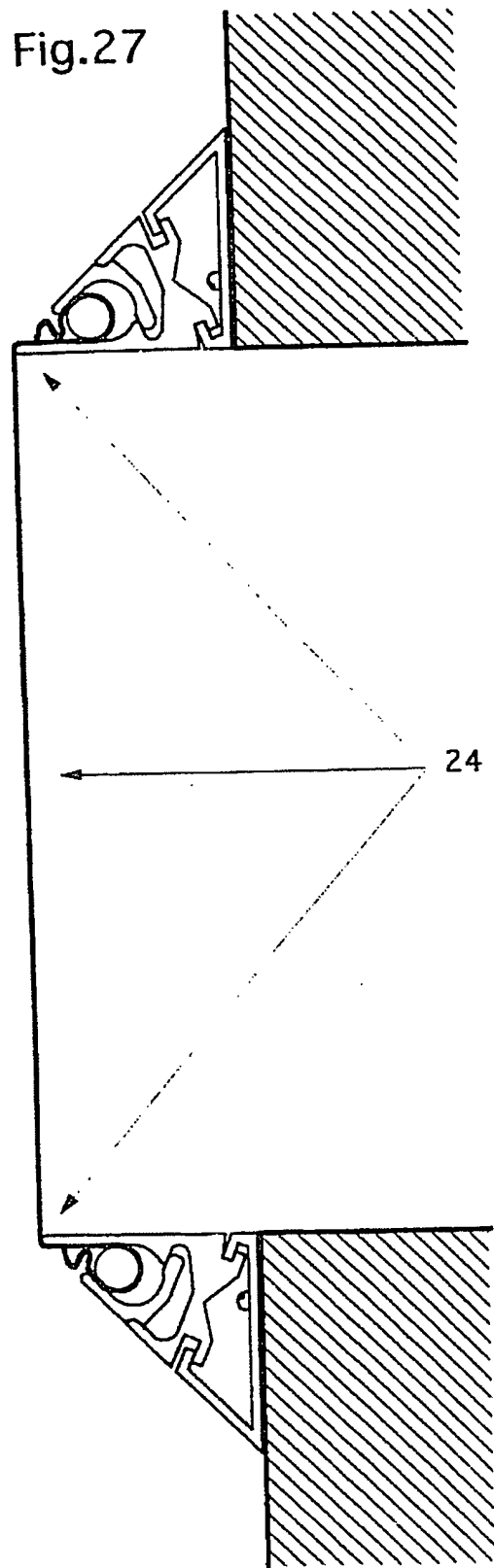
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Fig. 26



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Fig.27



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Fig. 28

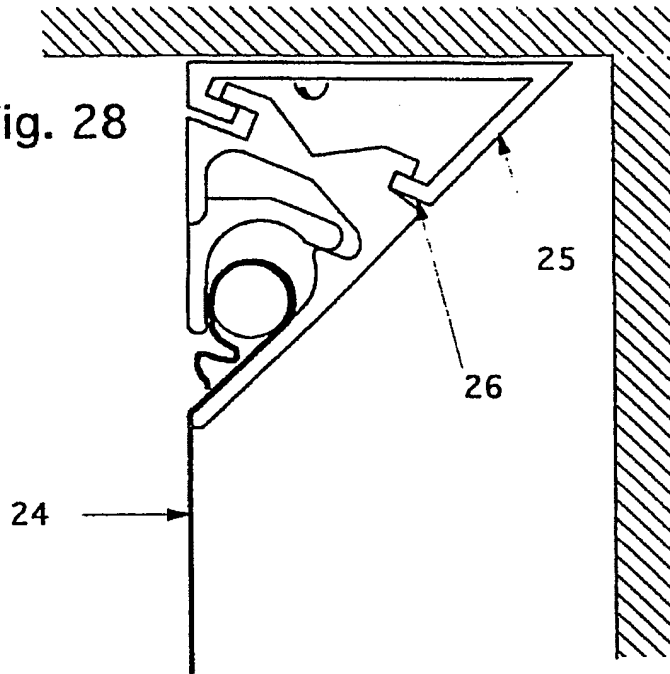
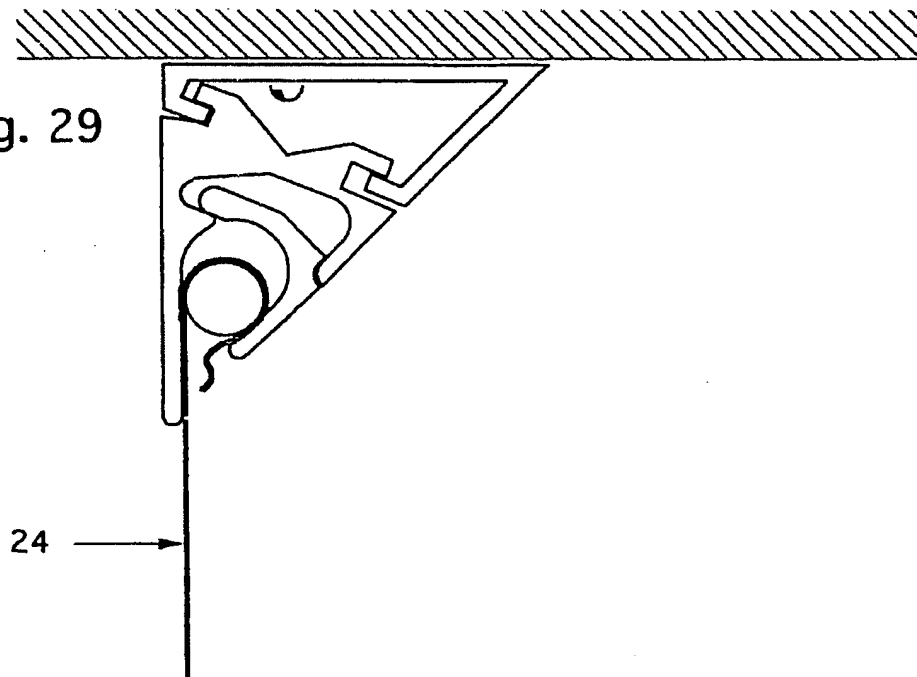


Fig. 29



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Fig. 30

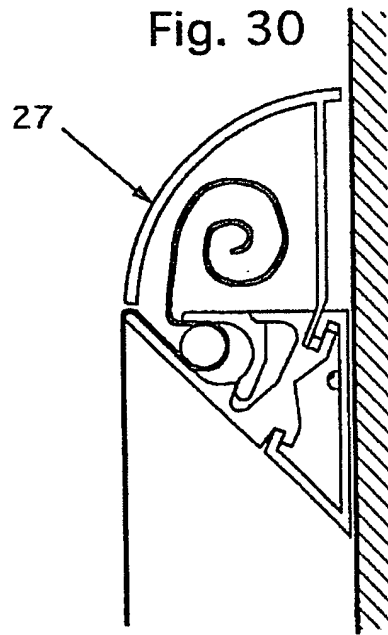
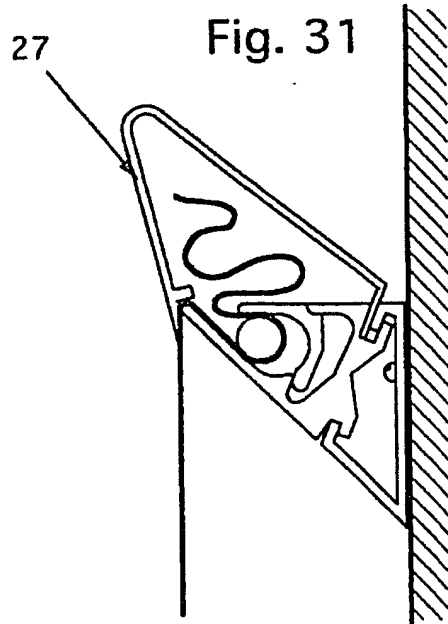


Fig. 31



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# INTERNATIONAL SEARCH REPORT

Inte. onal Application No  
PCT/NL 00/00912

A CLASSIFICATION OF SUBJECT MATTER  
IPC 7 F16B5/06 B44D3/18

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
IPC 7 F16B A01G B65D B44D D05C E04H G09F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and where practical search terms used)

EPO-Internal

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication where appropriate of the relevant passages	Relevant to claim No
X	FR 2 733 805 A (PINGON MAURICE) 8 November 1996 (1996-11-08) abstract page 5, line 30 -page 7, line 27 figure 5	1,3,7,8
X	US 3 143 165 A (LEWIS ETAL T W) 4 August 1964 (1964-08-04) column 5, line 28 -column 6, line 6; figure 3	1,5,7,8
X	US 4 571 897 A (KERR FRED) 25 February 1986 (1986-02-25) abstract column 7, line 62 -column 9, line 9 figures 4,6,9	1,2,4

☒ Further documents are listed in the continuation of box C

☒ Patent family members are listed in annex

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Date of the actual completion of the international search

27 March 2001

Date of mailing of the international search report

09/04/2001

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# INTERNATIONAL SEARCH REPORT

International Application No

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## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document with indication where appropriate of the relevant passages	Relevant to claim No
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A	claims 1-5 figures 1-9	6
X	GB 1 037 236 A (COVENTRY MOTOR AND SUNDRIES CO) 27 July 1966 (1966-07-27) page 1, column 1, line 22 -column 2, line 63; figures 1-7	1
A	DE 91 03 345 U (E. UND R. STOLTE GMBH) 20 June 1991 (1991-06-20) page 5, paragraph 3 -page 6, paragraph 2 figures 5,6	9

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/NL 00/00912

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